

invention was conceived (it is noted that the earliest priority date of the present application is September 29, 1990). On this basis the applicant has argued that, at the priority date of the invention, it was not obvious to use acoustic data transmission through drill strings for any practical purpose and that there was an inventive step in employing such acoustic data transmission in the particular manner defined in the present claims.

The Examiner has noted that no objective evidence has been submitted in support of the applicant's arguments.

A Web search has been conducted to attempt to locate any references concerning the use of acoustic data transmission through drill strings, of the type taught by Montgomery and Bockhorst. No such references have been located. It is submitted that this in itself strongly supports the applicant's argument that the use of such acoustic data transmission cannot be said to have been conventional at the priority date of the present invention and has not become conventional in the subsequent period. On the other hand, there are numerous references to "mud pulse telemetry", which the systems of Montgomery and Bockhorst sought to replace. Mud pulse telemetry was and remains overwhelmingly the conventional wireless data transmission method in downhole environments.

The Web search located a limited number of references to acoustic data transmission through drill strings. It is submitted that these references clearly support the applicant's arguments.

Enclosed herewith is a copy of an abstract for an Acoustics Seminar relating to "Acoustic Data Telemetry: Oil Drilling Application", which took place on February 11, 2000, University of Texas, Austin:
<http://www.me.utexas.edu/~acoustic/seminars/s00/abs0211.html>

This refers to the limitations of mud pulse telemetry, and notes that: "Acoustic telemetry (which uses the drill string as the information carrier) has the **potential** to significantly increase the rate of data transmission, by perhaps two orders of magnitude. **However, because of the periodicity of the drill string structure, several issues must be overcome. These include the highly dispersive and filtering properties of the waveguide,** as well as the inherent attenuation mechanisms in the environment." (emphasis added).

That is, in the year 2000, acoustic telemetry of the type proposed by Montgomery and Bockhorst was still viewed as having only the "potential" to replace conventional mud pulse telemetry because significant technical problems remained to be overcome. It is submitted that this provides clear objective evidence that the systems of the type proposed by Montgomery and Bockhorst have never been adopted or successfully implemented in practice and thus supports the argument that the present claims are non-obvious.

Also enclosed herewith is a copy of a brochure "Halliburton - Questions and Answers About Halliburton's New Acoustic Telemetry System (ATS)", dated 2000: <http://www.halliburton.com/products/tltstcp/h02322.pdf>

The Halliburton ATS employs acoustic data transmission through "tubing" (as distinct from drill pipe). The brochure includes the question "Why does the ATS system require tubing?", to which the answer is given "Due to extreme attenuation (signal loss), drill pipe cannot be used". That is, in the year 2000, the use of acoustic data transmission through conventional drill strings was regarded as being impractical by Halliburton, one of the world's leading providers of products and services for oil and gas exploration and production. Again, it is submitted that this provides clear objective evidence in support of the applicant's arguments.

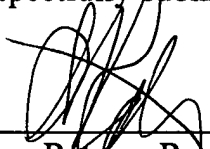
Reference is also made to US Patent No 6,108,268 (Moss), dated August 22, 2000 (filed January 12, 1998) (copy enclosed). Moss concerns impedance matched joined drill pipe, specifically for the purpose of enabling acoustic data transmission through a drill string fabricated from the drill pipe. In the "Background to the Invention", Moss discusses the limitations of conventional mud pulse telemetry and the fact that efforts to transmit data acoustically through drill strings have been ongoing for forty years, noting: "The main impediments (past and present) to commercialization of a system that uses the drill string for data transmission are noise, echoes, and obtaining sufficient power downhole to power the acoustic transmitter. ... Various prior efforts have been directed to arrangements for data transmission, but none have been commercialized." It is submitted that Moss further supports the applicant's arguments.

conventional data transmission by mud pulse or wireline methods. Prior to the present invention, the only proposals for the use of acoustic data transmission sought to transmit data over large distances through a drill string. None of these proposals were capable of being successfully implemented in practice. This statement is supported by the objective evidence referred to above. The prior art of record provides no suggestion that acoustic data transmission might usefully be employed in any circumstances where the data is transmitted only over a short distance. The present invention provides a solution to a particular problem associated with conventional downhole telemetry systems. This solution is neither disclosed or suggested by the prior art of record. If the acoustic data transmission systems exemplified by Montgomery and Bockhorst had been capable of being successfully implemented, then these would provide a complete solution to the problem addressed by the present invention, allowing data to be transmitted between any two points in a drill string while by-passing any obstructions.

The claimed invention involves a non-obvious inventive step in recognizing that acoustic data transmission could be reliably employed only over a relatively short distance, and that this would be sufficient and useful for the purpose of by-passing an obstruction in the interior of a drill string, thereby providing a solution to a significant problem in the art.

In view of the foregoing remarks, it is submitted that all of the claims now pending are allowable over the prior art of record.

Respectfully submitted,



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Encs - Copy of Abstract for Acoustics Seminar

Copy of "Questions & Answers About Halliburton's New Acoustic Telemetry System"

Copy of U.S. Patent No. 6,108,268

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